GOVERNMENT OF PUERTO RICO
PUERTO RICO PUBLIC SERVICE REGULATORY BOARD
PUERTO RICO ENERGY BUREAU

IN RE:	**CASE NO. NEPR-MI-2021-0002**
REVIEW OF THE PUERTO RICO ELECTRIC POWER AUTHORITY'S 10-YEAR INFRASTRUCTURE PLAN-DECEMBER 2020	**SUBJECT: Informative Motion on Two Proposals Under the Smart Grid Investment Matching Grant Program of the U.S. Department of Energy**

INFORMATIVE MOTION ON TWO PROPOSALS UNDER THE SMART GRID INVESTMENT MATCHING GRANT PROGRAM OF THE U.S. DEPARTMENT OF ENERGY

TO THE PUERTO RICO ENERGY BUREAU:

COME NOW LUMA Energy, LLC[1], and **LUMA Energy ServCo, LLC**[2], (jointly referred to as "LUMA"), through the undersigned legal counsel and respectfully submits the following:

1. On March 26, 2021, this Honorable Puerto Rico Energy Bureau ("Energy Bureau") issued a Resolution and Order in the instant proceeding, ordering —in pertinent part— that the Puerto Rico Electric Power Authority ("PREPA") submit to the Energy Bureau the specific projects to be funded with Federal Emergency Management Agency ("FEMA") funds or any other federal funds at least thirty (30) calendar days prior to submitting these projects to the Puerto Rico Central Office for Recovery, Reconstruction and Resiliency ("COR3"), FEMA or any other federal agency ("March 26th Order"). This Energy Bureau thereafter determined this directive applied to PREPA and LUMA. *See* Resolution and Order of August 20, 2021.

[1] Register No. 439372.
[2] Register No. 439373.

2. The Smart Grid Investment Matching Grant Program of the United States Department of Energy ("DOE") provides funding opportunities focused on enhancing the grid's resiliency and sustainability. The program's priorities include projects that increase the capacity of the transmission system, reduce outage impact, enable renewables, facilitate the aggregation and integration of (edge-computing) electric vehicles and other grid-edge devices, reduce CO2 emissions, and have an equitable impact on low-income communities.

3. To benefit from the aforementioned funding opportunities, LUMA plans to submit proposals under the Smart Grid Investment Matching Grant Program for the following projects: "Deploying Real-Time Situational Awareness and Control Technologies for a Flexible and Resilient Transmission Grid in Puerto Rico" and "REINFORCE: Northeastern Puerto Rico Energy Innovation Alliance for Outage Anticipation, Response, and Self-Healing Control during Abnormal Weather." *See* **Exhibit 1**. Both projects are highly relevant to LUMA's ongoing efforts to enhance the T&D System resilience and reliability. Especially when considering that PREPA's 10-year infrastructure plan includes improving sensor technology to enhance situational awareness in Puerto Rico. These projects comprise partnerships with a wide range of research institutions, utilities, and private companies, as described in detail in **Exhibit 1**.

4. Specifically, the "Deploying Real-Time Situational Awareness and Control Technologies for a Flexible and Resilient Transmission Grid in Puerto Rico" project seeks to increase grid flexibility and resilience, reduce the impact of extreme weather events, and facilitate reliable integration of renewable energy resources in Puerto Rico while supporting local communities. The main objective of this project is to deploy CORE APPS[3], centered around a

[3] Advanced PMU-based Power System Analysis Platform.

PMU-based Linear State Estimator and advanced analysis and control applications, to provide real-time situational awareness and effective control decision-making support in the LUMA's control to enhance the flexibility and resilience of the grid in Puerto Rico.

5. Meanwhile, the "REINFORCE: Northeastern Puerto Rico Energy Innovation Alliance for Outage Anticipation, Response, and Self-Healing Control during Abnormal Weather" project pursues advancing renewable energy resource forecasts to understand better the needs of the grid associated with adding those resources, as well as demonstrating technologies to improve the resiliency of the system, by deploying sensors to support the health assessment of critical portions of the transmission infrastructure so that better-informed decisions can be made to execute hardening. This project will help develop and demonstrate the capabilities of LUMA to provide higher levels of service, including improved resiliency in the face of disruptive events and the integration of renewable generation. It will provide awareness by improving the prediction of grid assets' capabilities to withstand disruptive events, including hiding wind speeds and earthquakes.

6. In view of the above, LUMA hereby requests the Energy Bureau to take notice of the above-described proposals it intends to submit under the Smart Grid Investment Matching Grant Program of the DOE to explore additional funding opportunities.

WHEREFORE, LUMA respectfully requests that the Energy Bureau **take notice** of the aforementioned.

RESPECTFULLY SUBMITTED.

We hereby certify that we filed this motion using the electronic filing system of this Energy Bureau. We will send an electronic copy of this motion to the attorney for PREPA, Joannely Marrero-Cruz, jmarrero@diazvaz.law.

In San Juan, Puerto Rico, on this 24th day of April 2023.

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Exhibit 1

IIJA Funding Opportunities

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1.0 Introduction

In 2021, President Biden signed the Infrastructure Investment and Jobs Act (IIJA) to encourage significant amounts of incremental spending to enhance different types of priority infrastructure, including electric utilities. This bill is divided into a larger number of funding opportunities, which are overseen by different federal agencies. Of these funding opportunities, some are allocated to the various states and territories on a formulaic basis, with the remainder being distributed competitively.

The Grid Resilience and Innovation Partnerships (GRIP) are a set of funding opportunities focused on enhancing the resiliency and sustainability of the grid. The funds associated are distributed by the U.S. Department of Energy (DOE). One of the subsets of a larger category within GRIP is known as the Smart Grid Investment Matching Grant Program, established under Section 1306 of the Energy Independence and Security Act of 2007.

LUMA's Priorities for this program include projects that:

- Increase the capacity of the transmission system
- Outage reduction impact
- Enablement of renewables
- Facilitate the aggregation and integration of (edge-computing) of EVs and other grid-edge devices
- CO_2 emissions reductions
- Equitable impact on low-income communities

$600 million is appropriated annually for this program for fiscal years 2022–2026 with a maximum of $50 million for each individual project. The parties involved in the grant request for each individual project are expected to spend an equivalent amount as cost-share.

In the first year of this program being active, LUMA Energy is submitting two complete applications, described in more detail below.

2.0 Deploying Real-Time Situational Awareness and Control Technologies for a Flexible and Resilient Transmission Grid in Puerto Rico

2.1 Introduction

Integrating greater amounts of renewable generation and providing higher levels of resiliency requires enhanced levels of situational awareness. This project seeks to deploy advanced sensors known as phasor measurement units (PMU) on the transmission system, allowing the control capability to leverage the data from these sensors to provide that situational awareness and meet the sustainability and resiliency goals of LUMA and stakeholders, including the integration of large-scale renewable energy deployment.

This project represents a partnership of LUMA Energy, V&R Energy, a leading provider of advanced power system analysis software and engineering solutions, the University of Puerto Rico-Mayagüez, and the Colorado School of Mines.

As described in PREPA's 10-year infrastructure plan, the island's T&D System is in need for improved sensor technology as well as enhanced control capabilities to leverage them to further support transformation of the grid into a more resilient and reliable system. Projects like this help develop and deploy capabilities to meet such goals.

2.2 Existing Conditions

LUMA today has additional need for enhanced situational awareness of the T&D System, including gaining greater system visibility, as well as expanding necessary control capabilities. To respond to such challenges, LUMA is seeking to deploy significant quantities of sensors across the transmission and distribution systems. Currently, LUMA has received an obligation from FEMA for the deployment of a modern Energy Management System (EMS) that would provide enhanced levels of situational awareness. However, additional needs exist.

2.3 Project Goals

The project goal is to increase grid flexibility and resilience, reduce the impact of extreme weather events, and facilitate reliable integration of renewable energy resources in Puerto Rico while supporting local communities. As an island, the Puerto Rico grid is more susceptible to fast system dynamics, which are expected to increase with the number of inverter-based resources (IBRs). To achieve this goal, we propose to deploy CORE APPS – Real-Time Situational Awareness and Control Technologies for a Flexible and Resilient Transmission Grid – An Advanced PMU-based Power System Analysis Platform. CORE APPS platform will be based on V&R Energy's PMU-based technologies and allow for fast and accurate linear system state estimation, real-time situational awareness, and controls, essential for capturing fast real-time dynamics of inverter-based renewable resources. To support the deployment of CORE APPS, the project will leverage the deployment of PMU infrastructure and the team's extensive

deployment and application experiences, and coordinate with LUMA's other grid modernization efforts, particularly the EMS replacement. Furthermore, the project will advance community benefits and develop an expanded high-skilled workforce in the power and energy sector, particularly young professionals from disadvantaged communities (DACs) in both Puerto Rico and the mainland U.S., contributing to the Justice40 Initiative, a federal government initiative to increase the flow of benefits of federal investments to disadvantaged communities.

2.4 Proposed Approach

The main objective of this project is to deploy CORE APPS, centered around a PMU-based Linear State Estimator (LSE) and advanced analysis and control applications, to provide real-time situational awareness and effective control decision-making support in the LUMA's control to enhance the flexibility and resilience of the grid in Puerto Rico. This project will directly support key objectives as follows:

- Increasing the capability of the transmission system to reliably transfer increased amounts of electricity from renewable energy with topology optimization technology.

- Enabling and preventing faults that may lead to catastrophic equipment failures or other system disturbances through deploying automatic cascading outages analysis and mitigation.

- Reliably integrating variable renewable energy resources at the transmission level with PMU-based real-time situational-awareness and enhanced voltage stability analysis.

- Supporting faster system restoration during and after major weather events on the island.

The main outcomes of the project are:

- Transform community and regional resilience in Puerto Rico. Deployment of the CORE APPS platform will enhance Puerto Rico's power-system control and protection, enabling advanced real-time monitoring and situational awareness, increasing the transfer of electric energy from renewable energy resources, and granular control and protection of the transmission grid. The platform will support rapid, informed decision-making in response to major events that will improve both system and regional resilience. Moreover, these capabilities will enable LUMA to cope with an evolving operating environment, including an increasing number of fast-acting distributed IBRs. These will result in significant improvement of Puerto Rico's electric reliability to the level of the mainland US.

- Catalyze and leverage private sector and non-federal public capital for impactful technology and infrastructure deployment. The team will deploy and showcase a suite of impactful PMU-based capabilities on a small-scale system in Puerto Rico, with the success of this deployment project enabling wider adoption in the industry and encouraging private sector investment to improve and deploy them on a wider-scale.

- Modernize the electric grid to reduce impacts due to extreme weather and natural disasters and integrate variable renewable energy resources. The project will deploy PMU-based Potential Cascading Modes (PCM) and Optimal Mitigation Measurement (OPM) tools, which will result in enhanced situational awareness during fast-evolving events (including hurricanes) and provide timely and actionable information for operators to prevent faults leading to other disturbances and efficiently restore electric service after outages. In addition, the topology optimization and

enhanced voltage stability analysis tools will facilitate large-scale renewable energy integration, and support Puerto Rico to achieve the goal of 100% renewable energy by 2050, 60% by 2040, and 40% by 2025, set in the Puerto Rico Energy Public Policy Act (Act 17-2019).

2.5 Potential Impact

The funds currently available for rebuilding Puerto Rico's electric grid after Hurricanes Maria, Irma, and Fiona are mainly from FEMA and are focused on traditional grid investments. This project will also create a unique showcase and generate valuable experience for other utilities and companies to learn from and adopt the technology. The DOE funding will accelerate the adoption of this technology because such large-scale deployment would not be possible without federal support.

2.6 Project Budget

Table 1 - Project Budget by Role

Task	Total ($k)
LUMA Funding from DOE	$23,000
LUMA Portion Cost-Share	$24,000
Remaining DOE portion/partners' cost share	$18,000
Total	$65,000

2.7 Project Timeline

If awarded, the project is projected to be completed by the fourth quarter of 2027.

3.0 REINFORCE: Northeastern Puerto Rico Energy Innovation Alliance for Outage Anticipation, Response, and Self-Healing Control during Abnormal Weather

3.1 Introduction

Responding to disruptive events requires enhanced grid capabilities, including improved situational awareness. This project includes advancing renewable energy resource forecasts to better understand the grid needs associated with this addition, as well as demonstrating technologies to improve the resiliency of the system, by deploying sensors to support the health-assessment of key portions of the transmission infrastructure so that better-informed decisions can be made to execute hardening.

This project represents a partnership of a wide range of research institutions, utilities, and private companies, including the University of Connecticut, the University of Albany, the University of Puerto Rico-Mayagüez, New York University, City College of New York, the Puerto Rico Technological Institute, Eversource, ConEdison, Avangrid, and Line Vision. This coalition is seeking funding from the Department of Energy under the Grid Resilience and Innovation Partnerships (GRIP) Program, which is funded by the Infrastructure Investment and Jobs Act (IIJA), passed in 2021.

PREPA's 10-year infrastructure plan includes the need to improve sensor technology to enhance situational awareness. Projects like this can make this effort more effective.

3.2 Existing Conditions

LUMA today has opportunities to improve its understanding in a detailed way of how extreme hydrometeorological events can impact the grid, and how to appropriately harden the grid in preparation for both natural hazards and increased adoption of renewable generation.

3.3 Project Goals

The demonstration project will bring the following benefits:

- Advance the understanding of extreme hydrometeorological events and their impact on electric power infrastructure.
- Advance the design of electric power transmission and distribution infrastructure systems resistance to extreme wind and precipitation in complex terrains.
- Assess the operational added value of real-time line-rate and system health monitoring for optimal system performance and risk management.

- Assess the operational added value of and anticipate risks to the transmission and distribution systems for risk mitigation and management and provide accurate forecasts of renewable energy resources solar and wind in support of the Island's transition to full decarbonization by 2050.

3.4 Proposed Approach

LUMA is focused on two tasks in this larger project: (1) Power infrastructure health monitoring to support dynamic response modeling and outage and (2) failure prediction models and renewable energy forecasts.

Task one will focus on Power infrastructure health monitoring to support dynamic response modeling. To that end, LUMA will use two power lines as unique field testbeds; a 30 km 230 kV transmission line (Line# 50100) on the north side of the island containing 130 towers, and a 35 km 115 kV transmission line (Line# 36200) in the east side of the island composed of 260 towers. The northern line is in the highlands, and the eastern line is often subject to precipitation and landslides. Both were heavily impacted by Hurricane Maria, with more than 60% of the towers destroyed. The Towers chosen for monitoring will be based on historical data provided by LUMA Operations that have suffered damage from recent hurricane events. Towers and lines will be monitored in real-time year-round including the hurricane season for four years.

In task two, LUMA will help develop outage and failure prediction models and renewable energy forecasts. The demonstration in Puerto Rico will enable us to further develop a hybrid data-driven and physics-based model for outage prediction (OPM), transmission structures failure predictions (or FPM), and renewable energy forecasts (REF) using the detailed information from the sensors on the transmission and distribution structures and the weather variables.

3.5 Potential Impact

This project will help develop and demonstrate the capabilities of LUMA to provide higher levels of service, including improved resiliency in the face of disruptive events and the integration of renewable generation. It will provide awareness by improving the prediction of grid assets' capabilities to withstand disruptive events including hiding wind speeds and earthquakes.

3.6 Project Budget

Table 2 - Project Budget by Role

Task	Total ($k)
LUMA Funding from DOE	$2,200
LUMA Portion Cost-Share	$2,910
Remaining DOE portion/partners' cost share	$94,900
Total	$100,000

3.7 Project Timeline

If awarded, the project is projected to be completed by the fourth quarter of 2027.